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date: November 24, 1971

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from: B. A. Gropper, N. P. Patterson

B71 11024

subject: Trip Report - U.S. Antarctic Research  
Program, National Science Foundation  
Case 236

ABSTRACT

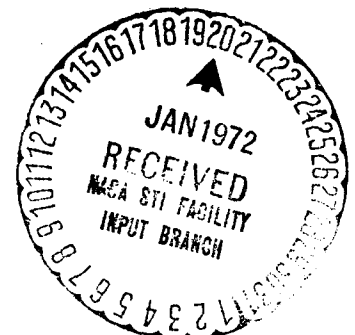
The costs of supporting large-scale research projects in remote and hostile environments, such as in the U.S. Antarctic Research Program, were discussed with representatives of the National Science Foundation. The relative proportion of total program costs for direct research grants (~\$3.5M/year) and logistic support (~\$23.5M this year) in these long-term polar studies are of interest as comparisons for current planning of shuttle sortie flights and other future space research efforts.

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MEMORANDUM FOR FILE

The authors discussed the U.S. Antarctic Research Program (USARP) with Mr. R. L. Dale, Office of Polar Programs, NSF, on November 2, 1971. The purpose of the visit was to obtain information related to the costs of supporting research projects in remote and hostile environments, such as the Antarctic, as part of a study comparing various ground and space research programs.

Large scale exploratory and scientific programs have been conducted in the Antarctic for many years. Scientific interest has been the principal motivation and the disciplinary areas studied have included biology, cartography, geology, glaciology, meteorology, oceanography, terrestrial and upper atmosphere physics. Immediate economic benefits have not been a significant factor in pursuing these programs.

Program Organization and Funding

The Office of Polar Programs in NSF coordinates, funds and manages all U.S. research activities in Antarctica. Logistics and other support are provided by DOD and DOT, but are paid for by NSF. The current total annual budget ('71-'72 season) is approximately \$27 million, and is expected to be maintained at a steady level of approximately \$30 million in the future. Only about \$3.5 million of this current funding is allocated directly to science research grants; the remainder goes to supporting the personnel and facilities that support the scientists.

About 50 research grants are awarded each year. Almost all of these studies are conducted in the October-February southern summer season. Typically, about 250



scientists and 2,500 support personnel participate during this peak period, with only about 10% remaining for the winter season.

Currently, about 12 nations are actively conducting such research, and almost all maintain permanent year-round stations on the continent. Although the exact number of stations varies as individual ones are activated and deactivated, the U.S. and the U.S.S.R. each have about four, and all routinely exchange foreign visiting scientists.

Most personnel are transported to Antarctica by aircraft, but almost all supplies are brought in by ship. All intra-Antarctic transfer of personnel and supplies is now done by air. Most traffic reaches the main U.S. base (McMurdo) via Christchurch, New Zealand, with a small proportion (~20%) being routed through Chile to sites along the Antarctic peninsula. During the summer season, ~20-25 round-trip flights are made between the U.S. and New Zealand, and about twice that many shuttle flights between New Zealand and McMurdo. (The one-way cost of a typical charter flight from the U.S. to McMurdo is ~\$36K.) Between stations on the continent, a total of roughly 4,000 hours of flight are made per season, of which only about 10% is devoted to direct inflight scientific research (such as mapping and remote-sensing surveys), the balance being for logistic support. Approximately another 2,000 hours of helicopter and local flights are made from McMurdo and icebreakers, of which about 25% is for direct science. Normally, none of the costs of transportation, housing and other logistic support are charged to individual research grants.

Only a small fraction of a typical grant is ordinarily required for instrumentation, since two fully equipped labs are maintained on the continent and they provide most instrumentation needed for Antarctic research.

#### Research Teams and Conditions

A typical research project team consists of about four scientists, including the principal investigator. Larger multidisciplinary teams are often organized, and account for about 30% of the scientific personnel and budget. Husband-and-wife research teams and a few female researchers have taken part in the program in recent years; but these have been only a small fraction of the participating population.



The typical time between an initial proposal and the start of a research project is about 12 months, but has been as short as 3-4 months for unusual opportunities (such as a volcanic eruption). All proposals undergo rigorous scientific review, but only about 50 of the 100-200 reviewed and recommended each year can be funded.

All participants undergo physical screening, and additional psychological screening is required for those who will "winter-over". Participants are rarely allowed to remain on the continent more than 12 months at a time. Regardless of the duration of a study, no individual is allowed to remain for two consecutive seasons. Seasonal participants are not permitted to have rotation and revisits because of the expenses of transportation.

Before departing from the U.S., all participants receive a week's indoctrination by experienced polar researchers and program managers. (1) (2) In New Zealand, they are issued personal equipment and clothing, and receive 2-3 days additional indoctrination before continuing on to their Antarctic bases. On the continent, parties that will be living at remote sites are given additional training in equipment operation and survival techniques. A significant proportion of the logistic support consists of survival and rescue gear.

After an initial brief period of personal adjustment and on-site preparation, most research teams settle into highly efficient, but individualized, work regimes -- working as much as 16 hours a day, seven days a week. Flexibility is possible because of the availability of continuous daylight and round-the-clock support. Extensive facilities (including medical, technical, recreational and PX) are available at the permanent bases. The isolation is relieved by liberal access to radio links (military and amateur) between the stations and home.

NSF considers it a distinct advantage to have the PI directly participate in at least one Antarctic trip, since this experience gives him a much more accurate picture of field conditions and enables him to be more realistic in his demands on field teams. After a PI has been to Antarctica, he may choose to have co-investigators conduct later field activities.

Although the Antarctic environment is inhospitable (e.g., temperatures in the interior go as low as  $-129^{\circ}\text{F}$ ), experience gained over the years has reduced the operational dangers. Accident rates on intra-continental flights have



decreased and loss of life on these flights has occurred at irregular intervals. For example, in the 12 years between 1956 and 1967, 25 persons were killed in six crashes. A total of 33 aircraft were lost.<sup>(3)</sup> In the 1970-71 season, three aircraft were involved in accidents, without loss of life. Most illnesses and injuries are treated on-site, but evacuation is possible in serious cases. The high level of safety in field research has been achieved by constant emphasis on survival and safety throughout the program.

In summary, the USARP has matured to the point where scientific research activities are routinely available to a large population, and are conducted with reasonable safety and efficiency.

An overall review of the effectiveness of USARP, including its current costs and methods is now being prepared by NSF for the Office of Management and Budget. This report, tentatively entitled "Antarctic Issues Study", is scheduled to be completed May 1, 1972.

  
B. A. Gropper

  
N. P. Patterson

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Attachment  
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